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T. Z. Sawyer Technical Consultants
Broadcasting & Telecommunications

August 20, 1993

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**FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY**

William Caton, Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

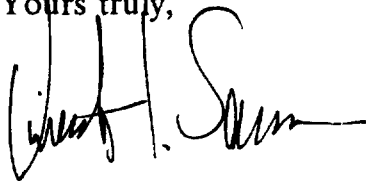
Re: MM Docket No. 93-177
An Inquire into the Commission's Policies and
Rules Regarding AM Radio Service Directional
Antenna Performance Verification.

Dear Mr. Caton:

Transmitted herein, (the original and 9 copies) are the comments of T.Z. Sawyer Technical Consultants, Chevy Chase, Maryland concerning MM Docket No. 93-177.

It is our desire that each Commissioner receive a copy of our comments in this proceeding.

Yours truly,



Timothy Z. Sawyer

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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of

An Inquire into the Commission's
Policies and Rules Regarding AM
Radio Service Directional Antenna
Performance Verification

}
} MM Docket No. 93-177
} RM-7594
}

COMMENTS OF
T.Z. SAWYER TECHNICAL CONSULTANTS

T.Z. Sawyer Technical Consultants
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**COMMENTS OF
T.Z. SAWYER TECHNICAL CONSULTANTS**

T.Z. Sawyer Technical Consultants (TZSTC) submits the following comments in the above captioned proceeding. TZSTC's principal is Timothy Z. Sawyer, a broadcast engineer and technical consultant to the industry for over 25 years. Mr. Sawyer has been directly responsible for directional antenna performance verification, directional antenna pattern adjustments, and the day to day operations of AM radio directional antenna systems. The firm of TZSTC provides technical consulting services to the broadcast industry during the construction permit and licensing stages of station authorizations and applications before the Commission.

General comments and observations.

Over the past two decades, the maintenance or preventive maintenance of directional antenna systems has deteriorated so as to be practically nonexistent at an alarming number of stations. Few qualified engineers remain at the station level that are able to diagnose or correct errant antenna systems. Many of the directional antenna systems operating today may not be

operating within licensed technical parameters. The Commission, by its action in MM Docket 87-267, advanced the reduction of future interference levels by its frequency allocation procedures. The opportunity to correct the amount of interference caused by existing directional antenna systems that are not in compliance with their licensed operating parameters and future errant directional antenna systems now faces us.

It would be impracticable to suggest a return to the pre-1970's period of monitoring and compliance verification. The burden of the pre-1970's record keeping and reporting requirements would tax an already financially troubled service and the Commission's resources. However, some method of compromise between what was then, and what is now, must be found. The gains of future interference reduction promised by the actions taken in MM Docket 87-267 must not be lost because of the inability of the Commission to monitor and enforce a station to operate within the technical terms of its authorization.

Performance verification of licensed stations.

The nighttime city of license coverage requirement requires an accurate prediction of a station's nighttime interference free signal level be made. This prediction is based upon the antenna radiation patterns of other co-channel and adjacent channel stations. Therefore, the extent of service provided to

the local community is directly dependent on the proper adjustment of the antenna radiation patterns of other stations.

We are suggesting that a technical assurance mechanism be placed in the transfer or sale procedures of directional AM stations. A partial proof of performance of a directional antenna system at the time of station transfer would be required. In simplistic terms, consider this analogous to a motor vehicle inspection at the time of its sale or transfer. It would provide a means to correct those operations that are transferred from licensee to licensee with little regard to correcting technical problems.

Stations not transferred during the course of the license period would be required to submit the same technical certification during the license renewal process. This would insure that at least sometime within the license period the station is operating correctly.

Distribution of number of towers - directional operations

There are approximately 7,512 licensed AM radio stations, an additional 1,184 pending applications or granted construction permits are now on file. Many of the pending applications and Construction Permits are for existing stations, (only 101 have "NEW" listed as their call letter designator,) thus, the individual totals should not be summed. Of the 7,512 stations listed as licensed, 2,716 (36%) utilize a directional antenna during some part of

their day to day operation. Of those, 40 percent are in use during the daytime, 56 percent at night, and 4 percent employ the same system day or night. Of the pending applications and construction permits on file, 715 (60%) propose using a directional antenna system during some portion of their operating schedule. ¹

A table of tower distribution, i.e., number of towers employed per directional antenna system, has been constructed from the licensed and applications/construction permit totals.

Directional Antenna Systems - Number of Towers Employed			
<u>No. of Towers</u>	<u>Licensed Oper.</u>	<u>Applic./C.P.'s</u>	<u>% of Change</u>
2 Towers	38 %	27%	- 29%
3 Towers	33 %	33%	No Change
4 Towers	22 %	28%	+ 27%
5 Towers	2 %	4%	+100%
6 Towers	4 %	7%	+ 75%
7 or More Towers	1 %	1%	No Change

The table demonstrates the increase in more complex directional antenna arrays proposed by applicants (4 or more towers). With the apparent increase in complex designs of directional antennas being proposed (based simply upon number of towers employed), we feel it is reasonable to require a regular inspection/certification program of all directional antenna systems to insure that they are operating correctly once they have been commissioned.

¹ FCC AM Engineering Database - 7/21/93

73.53 Requirements for authorization of antenna monitors.

The "heart" of a station's ability to monitor the performance of its directional antenna system lies in the capabilities of the antenna monitor. The antenna monitor must be reliable with repeatability of measurements without question. It is our belief that a new generation of antenna monitor should be proposed with built-in self-test functions. Basic phase and amplitude checks of the monitor's input devices, power supply voltages, or other parameters critical to the monitor's ability to provide correct measurements should be performed upon power up, and at operator initiation. Existing antenna monitors would be "grandfathered" for 5 years, provided, that within 2 years, licensees purchase a "type accepted" external, antenna monitor test device. This device would provide the appropriate test signals to verify the correct operation of the antenna monitor as determined by the antenna monitor manufacturer. Too often the errant performance of an antenna system has been questioned because of erroneous values being generated within the antenna monitor or other sampling system component. This in turn, has caused some licensees to attempt to adjust their directional antennas systems based upon values obtained from the defective antenna monitor. Once such adjustments are attempted, unless adequate precautions have been made, the likelihood of returning to the correct operating parameters is greatly diminished, this usually results in an adjustment of the antenna system done by trial and error. This attempted adjustment is usually based upon a one-point field intensity (monitor point) measurement in the

direction of concern, rather than a series of field intensity measurements along the radial as required in a more systematic approach. This type of adjustment can result in monitor point values within maximum allowable limits, but with inverse field radiation values exceeding the licensed radiation pattern.

73.62 Directional antenna system tolerances.

The present system tolerances of 3 degrees phase and 5 percent of the sampling loop current ratios are adequate to insure the proper operation of most directional antenna systems. A relaxation of this requirement is not suggested. It has proven to be readily achievable by the majority of stations. However, deletion of the antenna base current tolerances requirement is proposed. The ability of station personnel to obtain antenna base current values for use only as an antenna diagnostic aid, would be required.

Antenna base current meters, despite the type employed, are subjected daily to the possibilities of damage because of the very environment in which they are required to operate. Damage caused by lightning strikes, antenna network component failures, and improper selection of meter scale all contribute to the question of reliability of the base current meter as a regulatory instrument.

73.68 Sampling systems for antenna monitors.

Shielded toroidal transformers should be required of new installations where practical (towers with an electrical height at or less than 110 degrees). The use of toroidal transformers at the base of the tower as a sampling device, eliminates the possibilities of damage to the sampling line between the tower base and the tower mounted sampling loop. It also provides improved long term stability of the array by removing the sampling line isolation coil across the base of the tower. A wider use of toroidal transformers as sampling devices, would allow station personnel access to all components of the sampling system for repair or evaluation.

Direct replacement of components with identical components across or above a tower base, should not automatically trigger the requirement for a partial proof of the system. For example, the replacement of a failed sampling system transmission line (vertical run) with an identical transmission line, in which no changes are noted in the operation of the array, between "before" failure and "after" replacement, should be allowed, with no further action required by the licensee. Any change, which results in a failure to reestablish the "before" failure antenna monitor parameters, without further adjustments, would however, result in a required partial proof of performance of the antenna system.

73.151 Field strength measurements to establish performance of directional antennas.

We feel certain that some commentators to this proceeding will suggest a relaxation in the field strength measurements required under this section of the Commission's rules. We do not agree with that position. The basis of the antenna proof of performance is to validate the directional antenna system as operating as designed. The use of various computer models to predict the performance of a directional antenna system greatly reduces the time spent in the field adjusting the antenna system. Thus, once an adjustment is found, the actual collection of the field measurement data can normally proceed without delay or undue expense. However, there are occasions, when an adjustment based upon a sampling of preliminary measurement points does not agree when the full measurement data is collected and analyzed.

Often, this can be accounted for as a scattering of radiofrequency energy as a result of ground conductivity discontinuities in the vicinity of the array, or other previously unaccounted for reradiators. The remedy, usually results in the standard pattern being modified under 73.152 of the rules. We are concerned that a reduction in measurements required during the full proof of performance will allow this type of discrepancy to go undetected.

73.158 Directional antenna monitoring points.

The use of monitoring points to verify correct operation of a directional antenna array assumes that station personnel will actually take monitor point readings, or that they can even find them. Again, due to the turnover of personnel and the qualification thereof, the reliance on the monitor point value is meaningless. For monitor point values to have meaning implies a knowledge (history) of the measurement point and its local environment. We suggest deletion of monitor point measurements in exchange for a yearly skeleton proof of performance of a formerly monitored radial. The preferred method would require non-directional and directional measurements on 8 or more points between 3 and 16 kilometers from the transmitter site. Station's without the ability to accomplish a change to a non-directional mode (DA-2, etc.) would be allowed to measure and analyze in a DA to DA manner. The measurement point locations would be those used in the station's last full proof of performance.

73.189 Minimum antenna heights or field strength requirements.

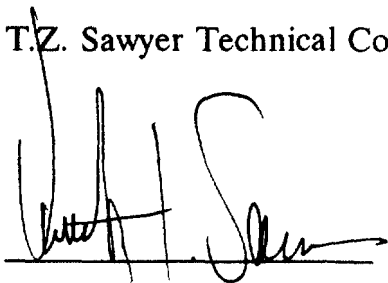
Rules requiring minimum RMS for the various classes of stations should remain in force. However, the method employed to meet the minimum RMS requirements would be at the licensee's discretion.

A station that proposes operations at sub-standard levels would unfairly utilize valuable radio spectrum, and should not be authorized.

Station's proposing to use non-conventional radiators or ground systems should be required to present, in the license application, evidence based upon field strength measurements, which clearly demonstrate compliance with the minimum RMS fields for the licensed class of station. The proposed use of non-standard radiators or ground systems at the construction permit stage should not hinder a construction permit from being granted, the burden of meeting the minimum standards should be correctly placed at the licensing stage. Thus allowing applicants an opportunity to experiment at their expense with non-standard systems.

Respectfully submitted,

T.Z. Sawyer Technical Consultants

A handwritten signature in black ink, appearing to read 'Timothy Z. Sawyer', is written over a horizontal line.

by Timothy Z. Sawyer
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August 20, 1993